Wildl. Soc. Bull. 17:50–52, 1989

CHRONOLOGY OF BLACKBIRD DAMAGE TO SUNFLOWERS

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Blackbird damage to sunflowers has become a major economic problem for growers in North and South Dakota and Minnesota. Blackbirds, specifically the red-winged blackbird (*Agelaius phoeniceus*), the yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and the common grackle (*Quiscalus quiscula*), caused approximately $3.6 and 6.5 million in sunflower damage in North Dakota in 1979 and 1980, respectively (Hothem et al. 1988). This dramatic increase in monetary loss is attributed to expanded sunflower acreage and higher market values. Studies during August and September, 1979 and 1980 (the bird-damage season), revealed that sunflowers represented 86% of the total esophageal contents of male redwings (Linz et al. 1984).

The purpose of our study was to determine when the majority of blackbird damage to sunflowers occurs, and how this damage is distributed within and among fields. Knowledge of relationships between sunflower maturity and temporal and spatial distribution of bird damage within fields will allow growers to adjust cultural practices and plan more effective and economical bird control strategies.

METHODS

We randomly selected 24 oil-variety sunflower fields ranging from 4 to 20 ha in areas with a history of blackbird use in North Dakota. We studied 4 fields in 1979, 6 in 1980, 10 in 1981, and 4 in 1982. Fields with different stages of sunflower maturity were selected to compensate for variations in bird pressure and weather conditions, and to determine if bird damage patterns varied with planting dates. Birds were not controlled in any of these fields.

The end of anthesis (flowering period) in sunflowers is marked by emergence of the last anther, which co-

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incides with the beginning of yellow ray flower drop (Siddiqui 1975). Fields are uniform in ray petal drop, which occurs within a 2- to 3-day period. We started surveys for damage at this time, when sunflower seeds in most of the peripheral tiers in heads are vulnerable to bird damage.

We surveyed each field for bird damage once every 3 days from ray petal drop until harvest in mid-October, sampling 3 equal strata to obtain a balanced distribution of sampling plots. During 1979, 1980, and 1981, we measured damage to flower heads within each strata in 33, 33, and 34 plots 1.52 m long, chosen randomly within each strata. In 1982, 80 0.91-m-long plots were used, adjusting the sample size based on analyses of data from previous years. We identified plots by attaching a small ribbon to sunflower stalks on both ends of each plot.

We measured the total surface area of developed and undeveloped seeds and area of bird damage on each flower head using the template method (Dolbeer 1975). Flower head diameters were measured with a flexible steel tape. Data from each head were converted to percent total damage by 3-day assessment periods. We conducted damage surveys after 1100 hours when most birds were loafing or had returned to roosts.

We used data from 1980 damage surveys to analyze the distribution of bird damage from the first and final assessments, and to determine if the amount of damage was related to certain habitat types that bordered test fields. We also compared the amount of damage that occurred within 46 m from the edge of each field to the rest of the field to determine if bird damage was associated with surrounding habitat.

During damage surveys in 1980 and 1981, we described each flower head in every tenth plot. We recorded color of back bowl (green, green-yellow, yellow, yellow-brown, or brown), position (upright, half-inverted, or inverted), and stage of seed development (milk, soft, or hard).

We estimated numbers and kinds of blackbirds using test fields from August to October at intervals of 1–5 days; we made 1 10- to 30-minute observation between sunrise and 1100 hours using the total count technique described by Meanley (1965). The starting point for bird observations was chosen randomly among fields to reduce potential time bias. Bird numbers were converted to bird-use per minute per hectare for comparisons among fields. Numbers of blackbirds on flightlines from roosts at dawn were estimated with block-counting procedures (Meanley 1965) at 14-day intervals between August and October at roosts associated with test fields.

RESULTS AND DISCUSSION

In test fields, >75% of the total bird damage occurred within the first 18 days after anthesis (Fig. 1). Damage then decreased gradually until harvest. Overall, 40% of bird damage to

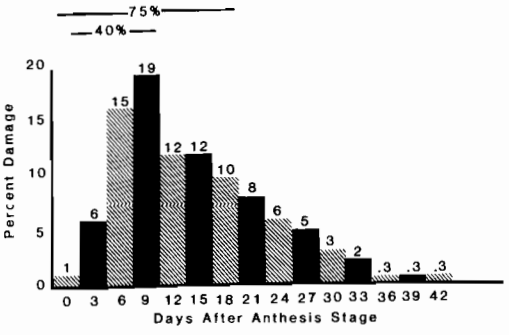

Fig. 1. Distribution of blackbird damage to sunflower fields in North Dakota, 1979–1982.

sunflowers occurred between 3 and 9 days after anthesis (Fig. 1). The greatest increase in damage occurred during this period.

The chronology of bird damage during 1979, 1980, 1981, and 1982 generally followed the same pattern. Peak bird damage occurred 15, 6, 9, and 9 days after anthesis, respectively, during 1979, 1980, 1981, and 1982.

Distribution of damage in 6 test fields ($\bar{x}$ = 15 ha) in 1980 was not different (Wilcoxon signed ranks test, $P = 0.12$) between plots on periphery of fields versus those in the interior. In most cases, damage fanned outward from the initial area of impact. Data from these test fields were different than that found by Knittle (unpubl. data). His findings showed that damage in fields ($\bar{x}$ = 12 ha) was 2.1 times greater in the periphery, a zone 46 m from the edges of the field, than in the interior.

Red-winged blackbirds constituted 80%, grackles 11%, and yellow-headed blackbirds 9% of all birds observed. Peak numbers of blackbirds feeding in test fields ranged from 800 to 45,000. In 1982, redwings constituted about 87% of all birds observed during the peak damage period (29 Aug–5 Sep). The average number of blackbirds entering test fields was 4, 11, 69, and 49/minute per hectare in 1979, 1980, 1981, and 1982, respectively. About 86% were observed between 3 and 18 days after anthesis, and 74% of damage occurred during this period. Subsequently, bird numbers dropped drastically.

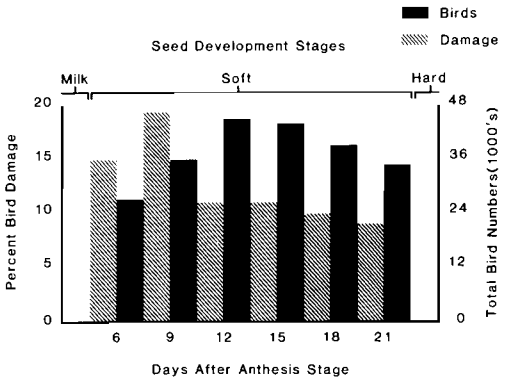

Fig. 2. Blackbird damage to sunflower fields in North Dakota, 1979–1982, as related to seed development and numbers of birds.

Counts at 6 roosts close to test fields peaked at 137,000 birds in the latter part of September (4-yr mean). Overall, redwings composed 74% of the roosting populations, yellowheads 14%, and grackles 12%, similar to species compositions observed in test fields.

In test fields, 64% of all bird damage occurred between 15 August and 16 September, with damage distributed about equally between these months. Seventy percent of damage occurred on sunflower heads with green and green-yellow bowls (receptacles), and 68% occurred when heads were half-inverted. Also, during the seed development stages, soft-seed received 76% of the damage (Fig. 2). These conditions coincided within an 18-day period after anthesis. Bird numbers tended to peak as fields reached the soft-seed stage. This suggested that soft stages of sunflower seed are preferred, and that birds will desert more mature fields to seek these fields (Fig. 2).

Major damage control efforts should be made during this short period to achieve the most favorable cost-benefit ratio during the 7- to 10-week damage period. Simulated blackbird damage has demonstrated that seed yields were similar for both undamaged heads and heads with $\leq 15\%$ of the seed removed during the first 2 weeks after anthesis (J. Q. Sedgwick, Denver Wildl. Res. Cent., unpubl. data), for example. This suggests that the sunflower plant can compensate for removal of $\leq 15\%$ of the seeds on a head during the first 2 weeks of seed formation, a period that coincides with the peak bird-damage period.

Efforts to disperse birds during the peak damage period should spread bird feeding over more fields, allowing growth compensation to keep sunflower yields in lightly damaged fields near those from undamaged fields. Although the length of peak periods may vary slightly from year to year because of bird numbers, palatability, distance from roost, and other environmental factors, growers should be advised to start dispersal efforts at the end of anthesis (when sunflower heads are green-yellow) if birds are present.

Acknowledgments.–We thank J. F. Besser, D. J. Brady, J. E. Davis, Jr., T. C. Hall, S. R. Kilburn, D. L. Otis, and M. P. Marsh for helping in various phases of this study.

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Received 8 December 1986.
Accepted 25 October 1988.